

Sandy Hook, 8,216; Punta Rassa, 8,117; Milwaukee, 8,064; Sandusky, 8,010; Wood's Holl, 7,953. The *smallest* are: La Mesilla, 1,138; Lynchburg, 1,523; Red Bluff, 1,777; Augusta, 1,966; Des Moines, 2,219; Mobile, 2,305; Olympia, 2,378; Morgantown, 2,653.

Local Storms.—West Randolph, Vt., on the 12th, violent hail-storm, with wind and heavy rain, width, $1\frac{1}{2}$ miles; stones as big as butternuts; over 2,000 lights of glass destroyed. Versailles, Ohio, on the 12th, very destructive hail-storm, seriously injuring tobacco and other crops. 18th, violent tornado, 14 miles SW. of Fargo, Dak.; track two miles wide, extending across the southern part of Cass county; one man killed, three severely injured, many houses blown down. August 24th, violent local storm one mile wide and seven miles long, swept over Great Neck, Little Neck and Creedmoor, Long Island, damaging many buildings and injuring crops. In addition to the damage done by the cyclone at and near Brownsville, 12th and 13th, the following are reported: San Diego, Tex., many buildings unroofed; at Collins and Banquete, railway bridges damaged; Goliad, Tex., great damage to buildings. Ft. Mojave, Ariz., 22nd, most violent storm, barracks blown down, four men killed and five wounded.

Waterspouts.—Near Hat Creek, Wyo., on the 29th, 2 p. m., moved from N. to S. for ten minutes in a zig-zag course. Red Canon, Dak., during night of 28th, destroying telegraph line for eleven miles.

Sand-storms.—Tuscon, Ariz., 3rd; Florence, Ariz., 9th; Winnemucca, Nev., 4th, 10th, 23rd, 28th.

VERIFICATIONS.

Indications.—The detailed comparison of the tri-daily indications for August, with the telegraphic reports for the succeeding twenty-four hours, shows the general percentage of verifications to be 84.8 per cent. The percentages for the four elements are: Weather, 91.0; Direction of the Wind, 78.1; Temperature, 86.8; Barometer, 82.7 per cent. By geographical districts they are: for New England, 86.0; Middle States, 86.7; South Atlantic States, 99.4; Eastern Gulf States, 84.9; Western Gulf States, 89.2; Lower Lake region, 87.1; Upper Lake region, 84.6; Tennessee and the Ohio valley, 85.0; Upper Mississippi valley, 77.4; Lower Missouri valley, 76.0; Northern Pacific coast region, 87.5; Central Pacific coast region, 100.0; Southern Pacific coast region, 94.6. There were 35 omissions to predict out of 3,813, or 0.92 per cent. Of the 3,778 predictions that have been made, 144, or 3.81 per cent, are considered to have entirely failed; 117, or 3.10 per cent, were one-fourth verified; 449, or 11.88 per cent, were one-half verified; 469, or 12.42 per cent, were three-fourths verified; 2,599, or 68.79 per cent., were fully verified, so far as can be ascertained from the tri-daily reports.

Cautionary Signals.—115 Cautionary Signals were displayed during the month, of which 87, or 75.7 per cent., were justified by winds of 25 miles per hour or over at, or within a radius of 100 miles of, the station. 9 Off-shore Signals were displayed, of which 6 or 66.7 per cent, were fully justified, and 9 or 100 per cent, justified as to direction. Three of the Off-Shore were changed from Cautionary. 124 Signals of both kinds were displayed, of which 93 or 75 per cent, were fully justified. 64 cases of winds of 25 miles and over per hour, from scattered stations, were reported, for which signals had not been ordered. The above does not include signals ordered for 49 display stations, where the velocity is only estimated.

NAVIGATION.

In the table on the right-hand side of chart No. III are given the highest and lowest stages of water, as recorded on the Signal Service river gauges, during August, 1880. The rivers have continued *low* throughout the month, and, except the Ohio and its tributaries, have gradually fallen. The highest waters in the Ohio, Tennessee and Monongahela occurred between the 21st and 28th.

High Tides.—Kittyhawk, 25th, 26th and 27th, unusually high tides, tremendous swell from the east. Galveston, 12th and 13th, very high.

Low Tides.—Cedar Keys, 29th.

TEMPERATURE OF WATER.

The temperature of water, as observed in rivers and harbors at Signal Service Stations, with the average depth at which observations were taken, is given in the table on the left hand side of chart No. II. At the following stations observations were not made on the dates indicated: Cleveland, 23rd to 29th, inclusive; Detroit, 4th to 10th; Key West, 15th to 31st; Milwaukee, 2nd to 11th; New London, 1st to 8th; Norfolk, 14th to 20th; Wilmington, 3rd to 8th; San Francisco, on the 1st.

The following were received too late to appear in the table. Punta Rassa, maximum, 89°; minimum, 78°; average depth, 13 feet. Cedar Keys, 87°, 74° and 14 feet.

ATMOSPHERIC ELECTRICITY.

Thunder-storms have been reported in too great numbers to permit their enumeration in detail, they have occurred, with greatest frequency, as follows: *Georgia*: 23rd to 25th. *Illinois*: on 23rd, 27th and 31st. *Indiana*: on 2nd, 10th, 20th, 28th to 30th. *Iowa*: 1st, 16th, 17th, 19th, 23rd, 26th and 27th. *Kansas*: 1st, 2nd, 4th, 20th, 24th, 25th, 27th to 31st. *Louisiana*: 8th and 13th. *Maine*: 21st. *Maryland*: 25th and 29th. *Massachusetts*: 12th, 21st, 25th and 29th. *Michigan*: 1st, 9th,

10th, 24th and 27th. *New York*: 2nd, 10th, 24th, 25th, 27th to 29th. *North Carolina*: 11th and 12th. *Ohio*: 2nd, 10th, 11th, 14th, 17th, 19th, 20th, 25th, 29th to 31st. *New Jersey*: 3rd, 11th, 12th, 24th, 25th, 28th and 31st. *Nebraska*: 16th, 23rd, 24th and 26th. *Missouri*: 1st, 16th and 31st. *Texas*: 16th and 17th. *Pennsylvania*: 2nd, 11th, 19th, 24th, 25th, 28th and 29th. *Tennessee*: 21st, 23rd and 27th. *Vermont*: 2nd, 9th, 20th, 24th and 28th. *Virginia*: 3rd and 10th. *West Virginia*: 28th and 29th. *Wisconsin*: 1st, 26th, 27th and 31st. On the Pacific coast, a thunder-storm occurred at San Diego, violent on the 17th, at Portland, Or., 17th, and near Dayton on the 2nd; lightning was observed at Red Bluff, Cal., on the 28th.

Auroras.—Auroras during August, 1880, have been frequent, and during the 12th and 13th, were of remarkable brilliancy, as well as wide-spread. The following displays, either isolated or covering a slight extent of country, occurred, namely: on the 1st, at Burlington, Vt., Mt. Washington, Bismarek, Pembina, New London; 2nd, at Bismarek and Pembina; 3rd, at Fort Buford and Pembina; 4th, Forts Buford and Stevenson, Pembina, Burlington, Vt. and Newport, Vt.; 6th, Fort Stevenson, Pembina, Mt. Washington, Newport, Vt., Gardiner, Me., Oswego; 7th, Des Moines, Pembina, Fort Buford, Harvard University, North Argyle, N. Y.; 8th, Pembina and Burlington, Vt.; 9th, at New Windsor, Ill.; 10th, Clinton, Ia., New Windsor, Ill. and at Harvard University; 14th, at Helena, Mont., Cornish and Gardiner, Me.; 15th, Deckertown, N. J.; 16th, Newport, R. I.; 21st, Newport, Vt.; 22nd, Harvard University; 27th, Pembina; 28th, Pembina and Wellsboro' Pa.; 29th, Wellsboro, Pa., and Newport, Vt. One aurora was observed on the Pacific coast at Umatilla, Or., on the 31st, from 9 to 11 p. m.: solid arch of light without beams; altitude 20° ; color pale white.

On the 5th, a general display occurred north of latitude 42° , which was reported from thirteen stations, extending from Gardiner, Me., westward to Fort Stevenson, Dak. The most southerly stations reporting were Buffalo and Thatcher's Island.

On the 12th and 13th a most remarkable and wide-spread aurora occurred. This aurora was observed at about one hundred stations, extending from Eastport, Me., to Bismarek on the 12th and Pembina on the 13th, westward of which point the heavens were obscured. The most southerly stations reporting on the 12th were Delaware Breakwater, Fort Whipple, Va., Jacksonburg, O., Springfield, Ill., and Independence, Mo., and on the 13th, Woodstock, Md., Spiceland, Ind., and Independence, Mo.. The detail of these two displays is omitted for lack of space. While neither arch nor segment was seen at many stations, the following were its most general characteristics: dark segment varying from 50° to 30° altitude; bright arch varying from 10° to 45° altitude; brilliancy intermittent; merry dancers, at many stations, in large numbers, while at others, few or no streamers appeared; motionless at a few stations, but generally a lateral motion of varying rapidity; at some stations waves of nebulous light rose in succession to near the zenith and then faded away, while at other stations white masses moved in all directions with undulatory motion; at one station the beams, silvery white, had a tremulous motion resembling ripened grain moved by a light breeze. At several stations coronas, more or less perfect, were seen with streamers extending far beyond the zenith. Color, variously on the 12th, white, silvery white, white changing to uniform green, red and white, straw color, light yellow, pinkish white and bluish white; 13th, white, silvery white, light gray, light yellow, yellow and crimson, yellow changing to purple, pale blue.

On the 26th an aurora was generally visible in New England, while the heavens were obscured in the Lower Lake region. It was reported from six stations, Deckertown, N. J., being the most southerly.

On the 31st a display occurred, probably extending from Orono, Me., to Bismarek. During that evening the heavens, in the Lake region, were generally obscured. The most southerly stations reporting, were: Harvard University in New England, and Breckenridge in the Northwest.

MISCELLANEOUS PHENOMENA.

Earthquakes.—San Diego, 29th, 1:10 p. m., slight. Barrington, N. H., 21st.

Mirage.—New London, 11th. Delaware Breakwater, 21st.

Forest and Prairie Fires.—Portland, Or., forest fires in vicinity from 1st to 29th, when extinguished by rains. Fort Gibson, 28th, prairie fires.

Zodiacal Light.—Yates Center, Kan., 3rd, 6th, 7th, 9th; Harvard University, Mass., 7th, 8th, 9th; Nashville, Tenn., 4th, 7th, 25th, 26th; Havana, Cuba, 6th, 23rd to 28th inc.

Halos.—But few solar and lunar halos have been reported during the month. The following lunar rainbows have been reported: Leavenworth, Kan., 17th. San Antonio, Tex., 12th, showing colors distinctly.

Locusts.—Dayton, W. T., myriads from 5th to 31st, direction of movement uncertain; garden truck damaged. Pomeroy, W. T., 1st, myriads moving SW. Pike's Peak on summit, 6th, moving west; 16th, near timber line, moving west.

Sunsets.—The characteristics of the sky at sunset as indicative of fair or foul weather for the succeeding twenty-four hours have been observed at all Signal Service Stations. Reports from 144 stations show 4,441 observations to have been made, of which 29 were reported doubtful; of the remainder, 4,412 or 84.4 per cent. were followed by the expected weather.